

5.0 Pedestrian Needs Analysis

We are all pedestrians at some point during the day, whether or not we walk the entire way to a destination, walk to transit, or simply walk to and from our car into a building. One goal of this plan is to evaluate indicators of current or potential pedestrian demand across the City of Carlsbad, such as presence of schools, transit centers, youth and elderly. Studying the distribution of certain population segments and land use types in Carlsbad helps us to understand where the greatest potential for a walking trip might be, and thereby allows the city to focus its resources in these areas. In addition to understanding the potential demand for walking, it is also important to understand current and potential barriers to walking, such as freeways, rail rights-of-way, unsafe intersections, and poor facility connectivity.

The key outcome of the pedestrian needs analysis presented in this chapter is a thorough understanding of current and potential pedestrian demands and barriers in the City, which then become the focus for project recommendations in Chapter 6.0.

5.1 Pedestrian Generators

This section summarizes the location and intensity of pedestrian generating land uses and subpopulations across Carlsbad. This analysis guides the planning process toward those areas of Carlsbad where investments in pedestrian facilities is most beneficial in terms of the current propensity for pedestrian activity⁴.

5.1.1 Total Population and Employment Density

Population density, measured as the number of persons per acre of residential land, is a strong indicator of potential pedestrian activity. Generally, higher population densities are associated with more urban environments, which tend to support pedestrian travel through mixed land uses and interconnected street networks.

⁴ The analysis of pedestrian generators and attractors is based upon methodologies employed by the City of San Diego's 2006 Draft Pedestrian Master Plan Citywide Implementation Framework Report. This methodology received broad public review by the City of San Diego and was widely supported by San Diego Association of Governments staff.

Figure 5-1 displays population density for the City of Carlsbad. As shown, the Village has some of the highest population densities within the City, ranging from 25 to 60 persons per residential acre. Low population densities occur in the City's southeast quadrant south of Rancho Santa Fe Road and just north of the City's border with Encinitas. There is a noticeable absence of population density in the central portions of the City, north of Palomar Airport Road, where the land uses are predominately office and industrial. Residential development is limited in this area in large part due to McClellan-Palomar Airport.

Figure 5-2 displays employment density for the City of Carlsbad. There are several locations with high concentrations of employment, including the Village, the area between Cannon Road and Palomar Airport Road, and the area along Marron Road which is the site of the Westfield shopping center. Low employment densities occur in the southeast quadrant, in the area bordered by Aviara Parkway and Rancho Santa Fe Road.

5.1.2 Pedestrian Dependent Sub-Populations

This section summarizes population characteristics associated with higher levels of walking, including youth, elderly, physically disabled, and median household income. Certain population characteristics, such as age and household income, have been shown to influence pedestrian activity. For example, youth tend to walk more given they cannot legally drive; elderly and physically disabled tend to walk or use sidewalk facilities more given physical impairments which may restrict their ability to drive; and finally, lower income households tend to walk more given their lack of access to vehicles for driving. Mixed land uses tend to generate higher levels of pedestrian activity since multiple and varying opportunities within close proximity of each other creates shorter trip lengths, which in turn increases the propensity to make a trip on foot.

Figure 5-3 displays the distribution of population younger than 16 years across Carlsbad. The distribution and intensity of youth generally follows the overall population density patterns, although there is a notable concentration of youth in the census block groups adjacent to Interstate 5, between Carlsbad Village Drive and Tamarack Avenue.

Figure 5-4 displays the distribution of population older than 65 years across Carlsbad. Locations of higher concentrations of elderly population generally follow similar patterns to the overall population, with notable concentrations in the census block groups along Carlsbad Village Drive,

Figure 5-1:
2000 Population Per Acre

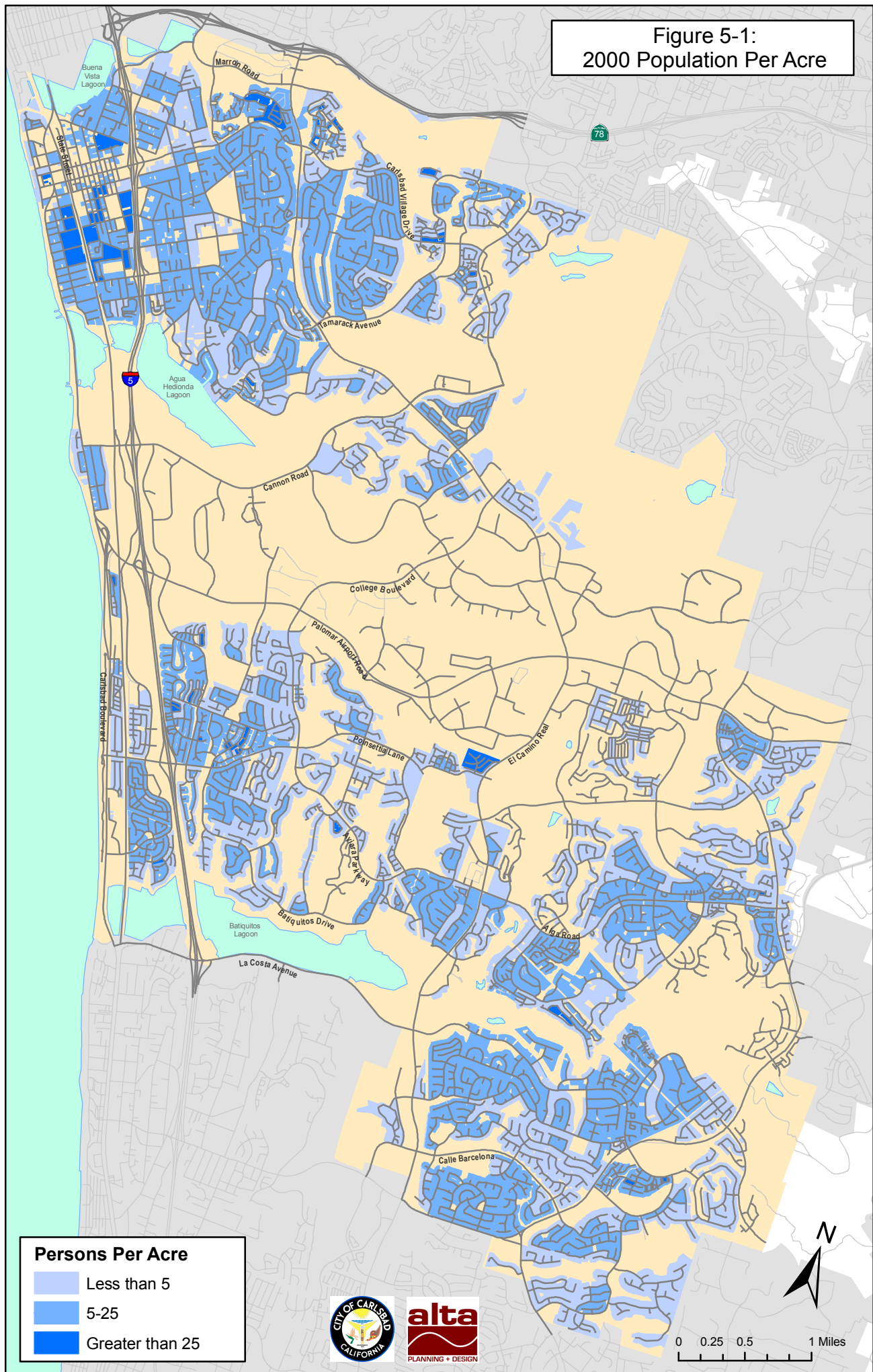


Figure 5-2:
2004 Employment Per Acre

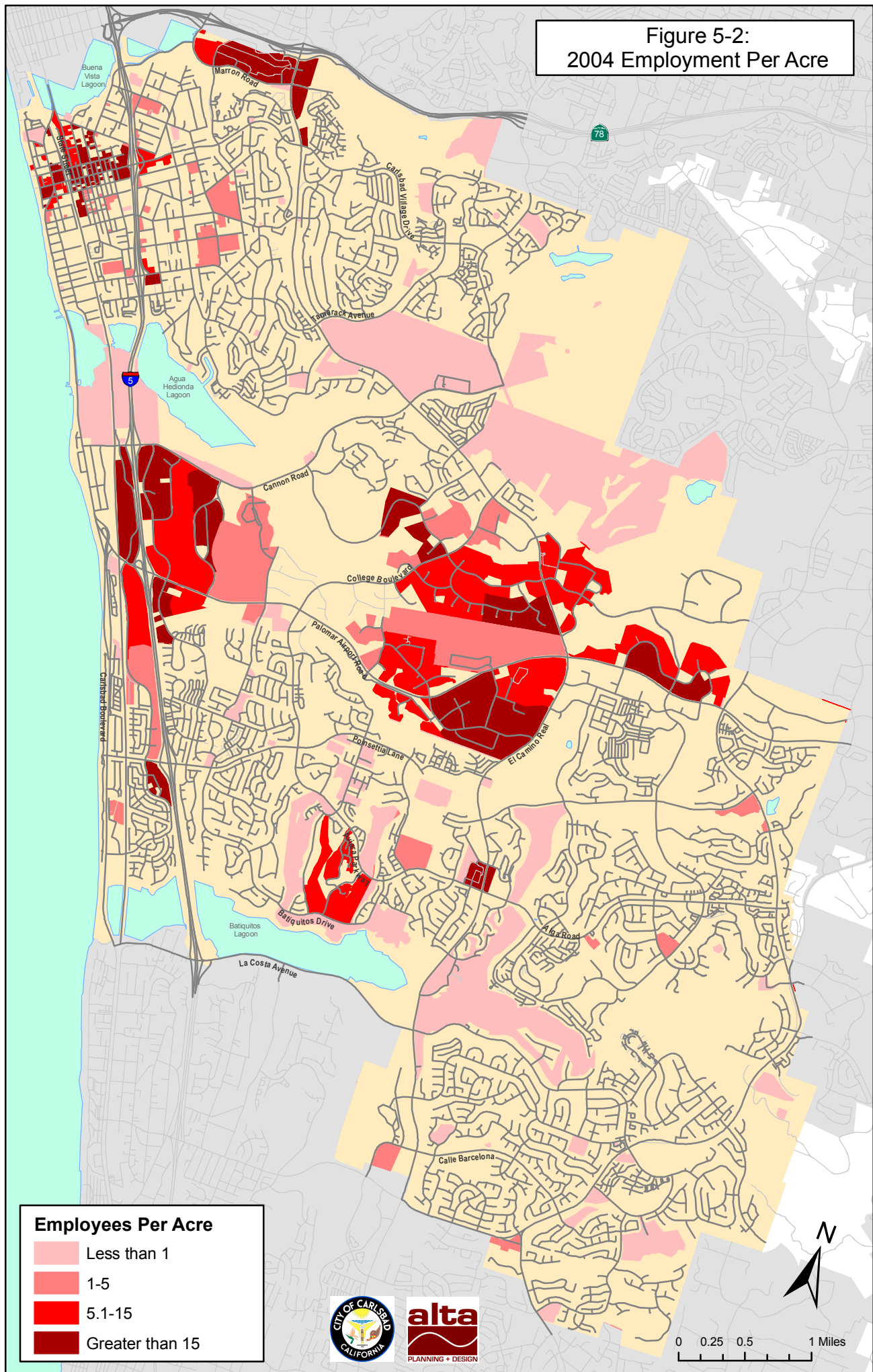


Figure 5-3: 2000 Youth Population
(Age < 16 years) Per Acre

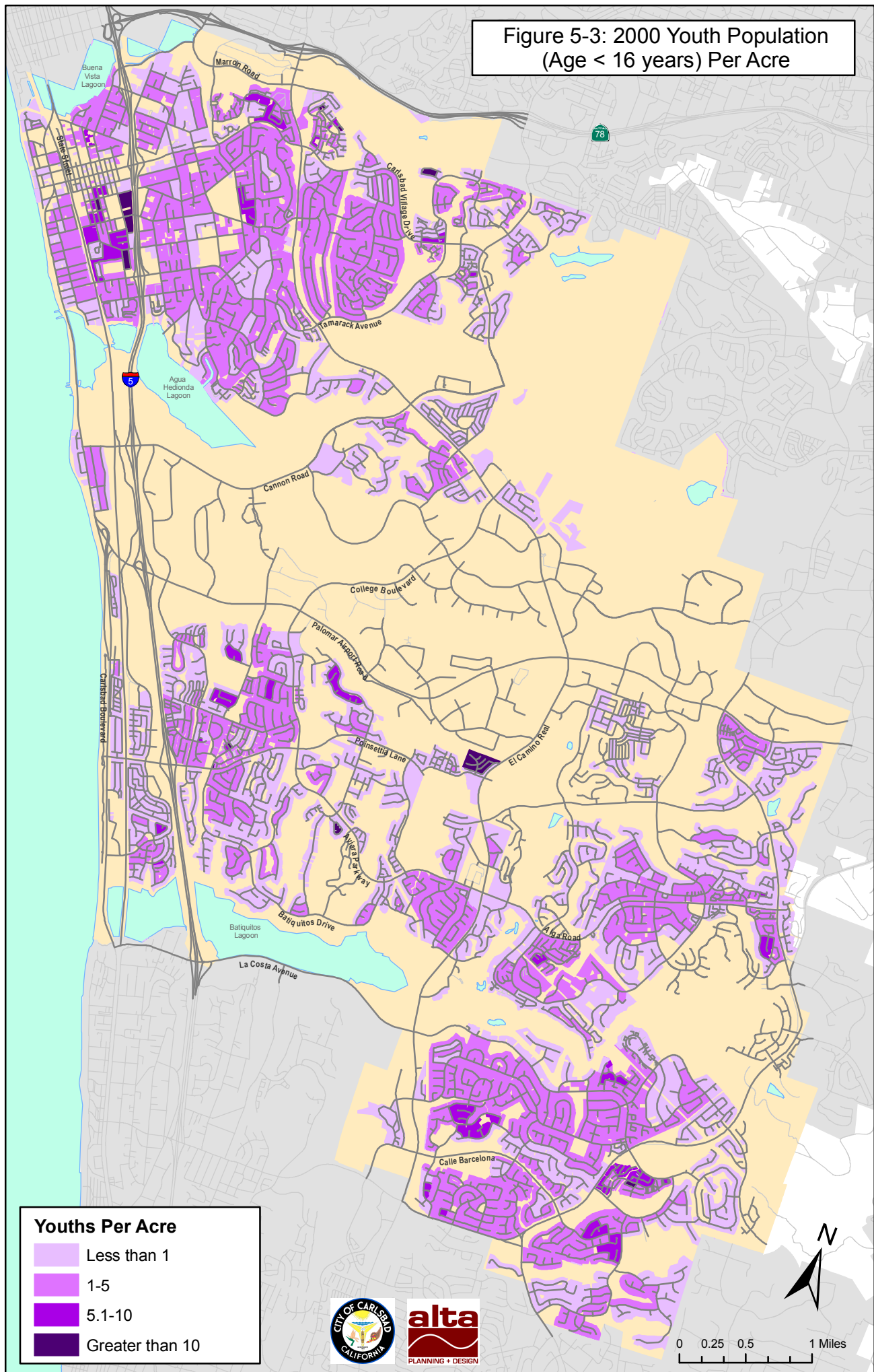
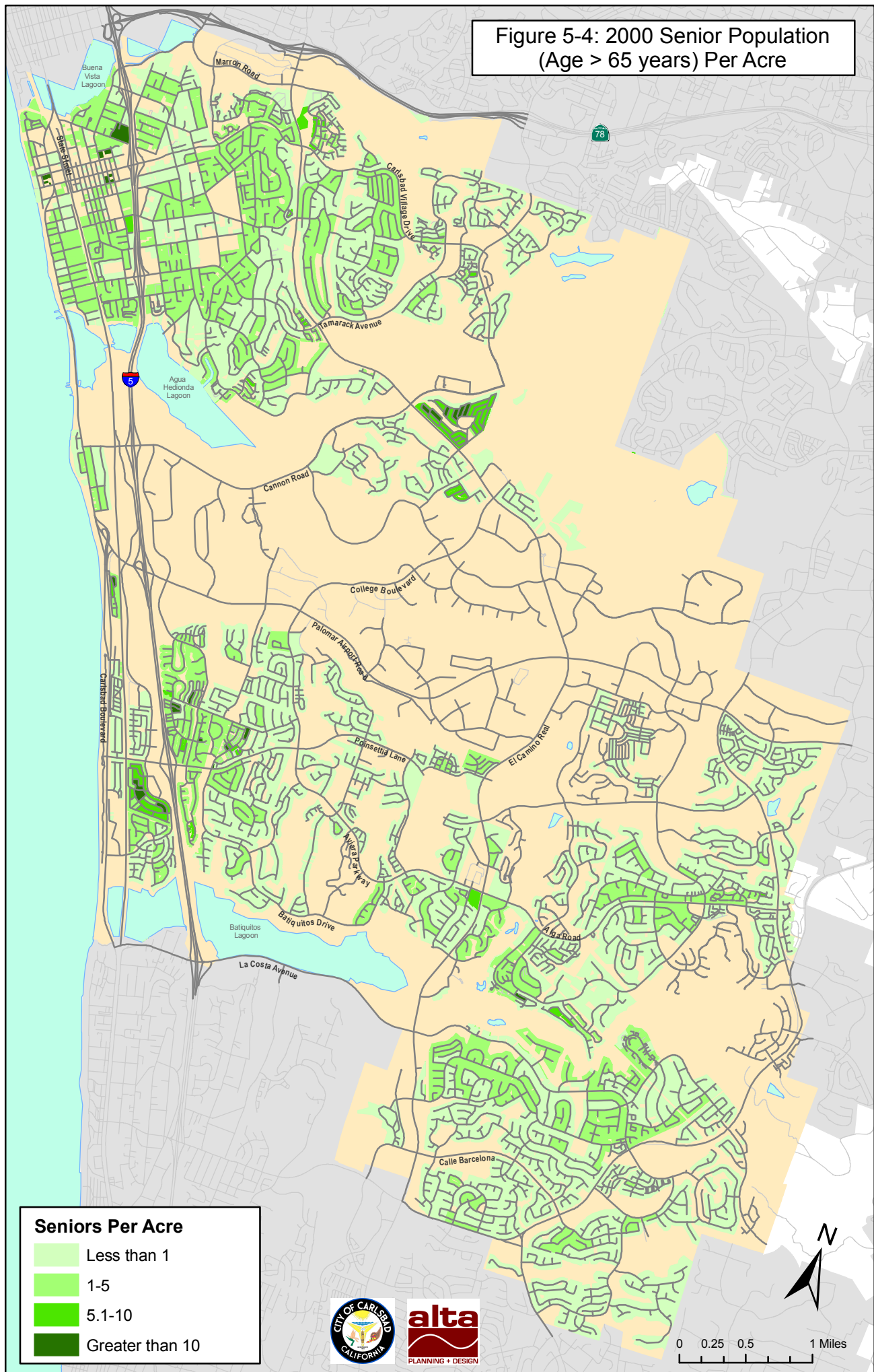


Figure 5-4: 2000 Senior Population
(Age > 65 years) Per Acre



west of Interstate 5; at the southeast corner of El Camino Real and Cannon Road, and at the southwest corner of Avenida Encinas and Poinsettia Lane.

Figure 5-5 displays the distribution of physically disabled population across Carlsbad. As shown, disabled populations are clearly concentrated in the Village, in the area bound by Carlsbad Village Drive on the north, Interstate 5 on the east, Carlsbad Boulevard to west, and Tamarack Avenue to the south.

Figure 5-6 displays the household income patterns across the City of Carlsbad. As shown, there is a distinct concentration of low income households in the area west of I-5, between Chestnut Avenue and Laguna Drive.

5.1.3 Final Pedestrian Generator Map

Figure 5-7 displays the final pedestrian generator map of all pedestrian generators for the City of Carlsbad, including population and employment densities, presence of population subgroups and mixed land uses. This map was developed using a GIS tool called Spatial Analyst which combines all of the individual generators, as discussed in the previous sections, into a single, composite file. The pedestrian generators are weighted individually, with higher values assigned to locations with higher levels of pedestrian generating features. Differing multipliers are also applied to the various pedestrian generators to account for the relatively greater importance of some generators over others. **Table 5.1** displays the pedestrian generators, along with the associated weights and multipliers.

Figure 5-5: 2000 Physically Disabled Population Per Acre

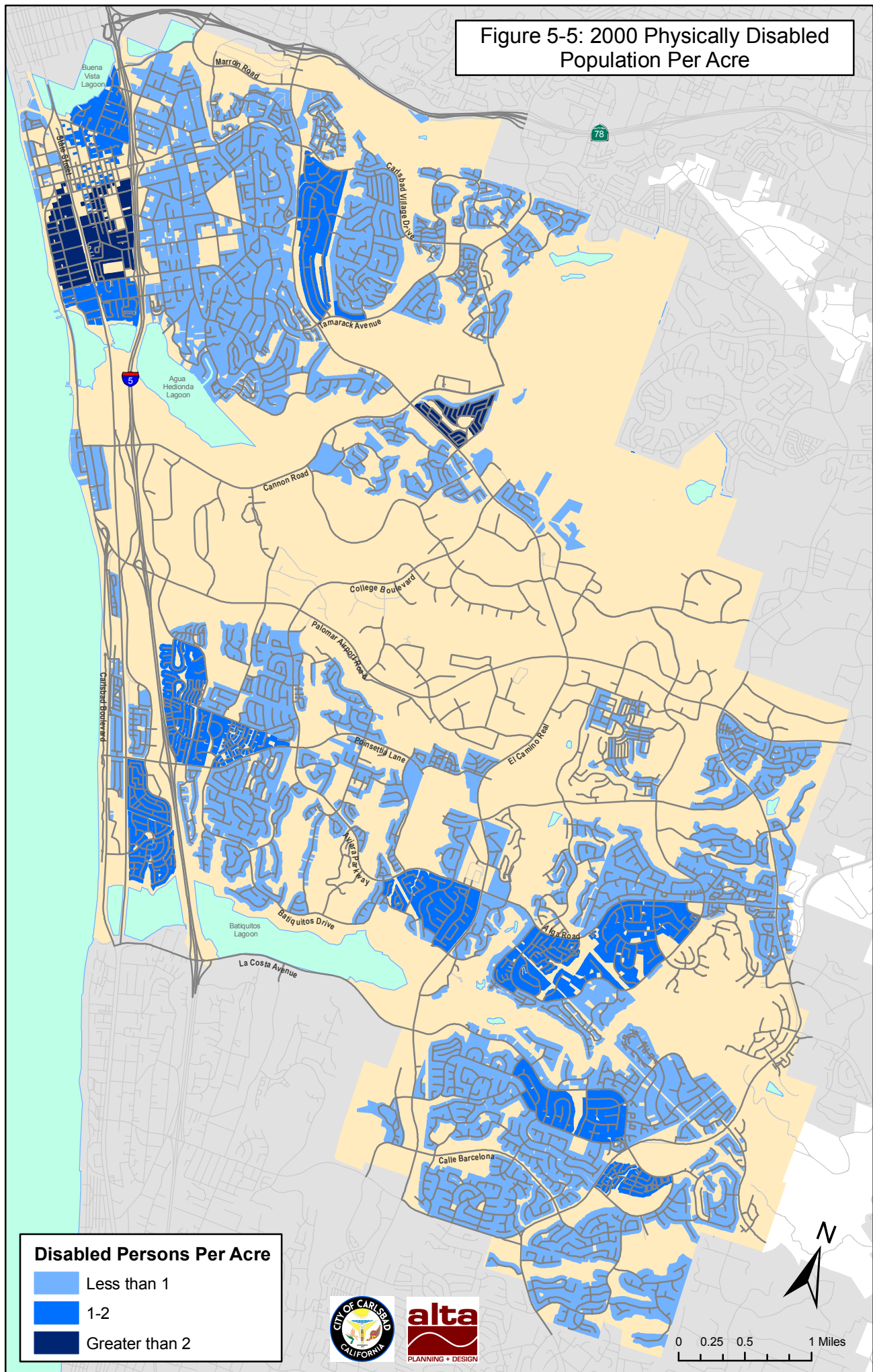


Figure 5-6:
2000 Median Household Income

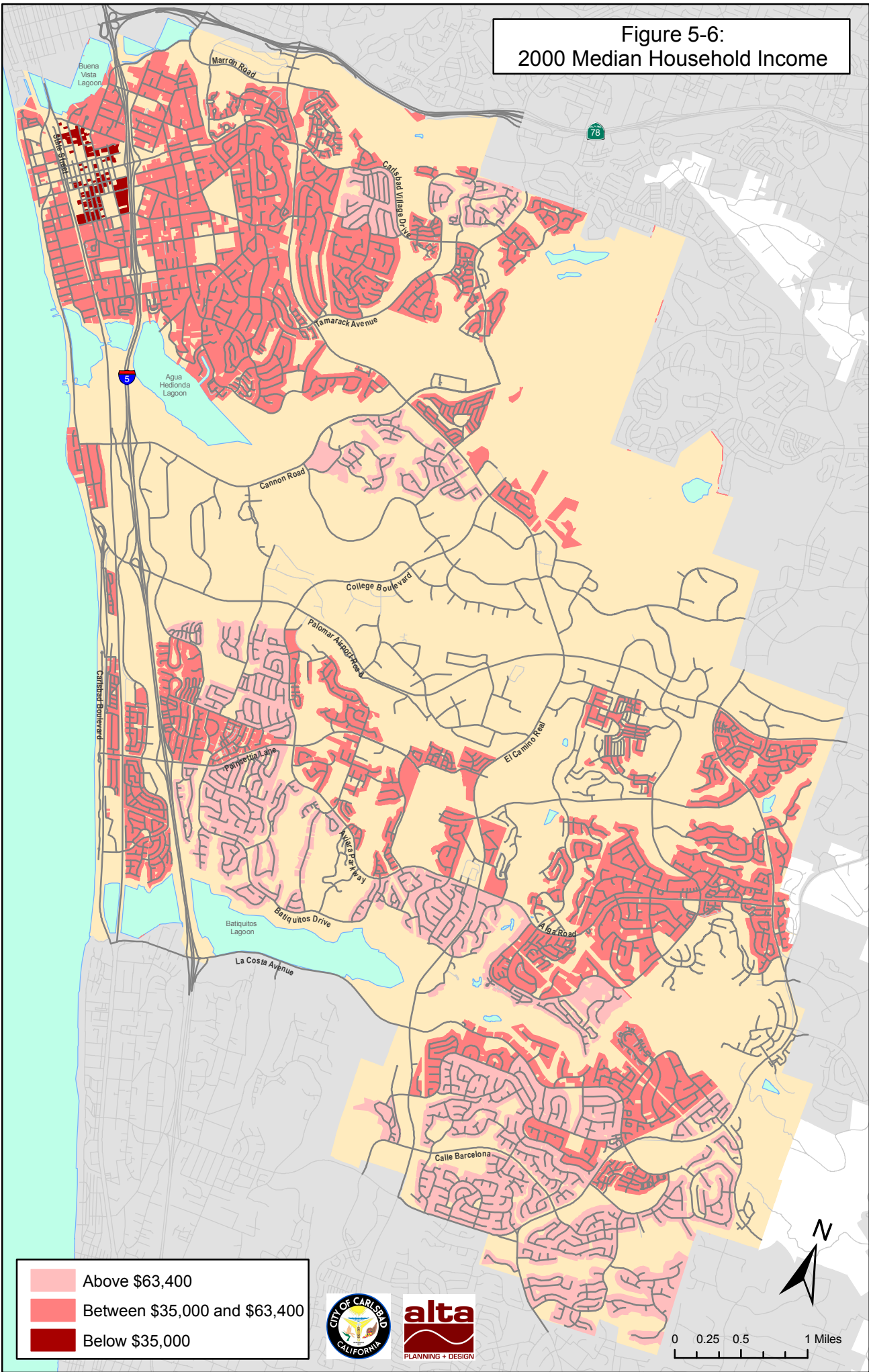


Figure 5-7:
Final Pedestrian Generator Map

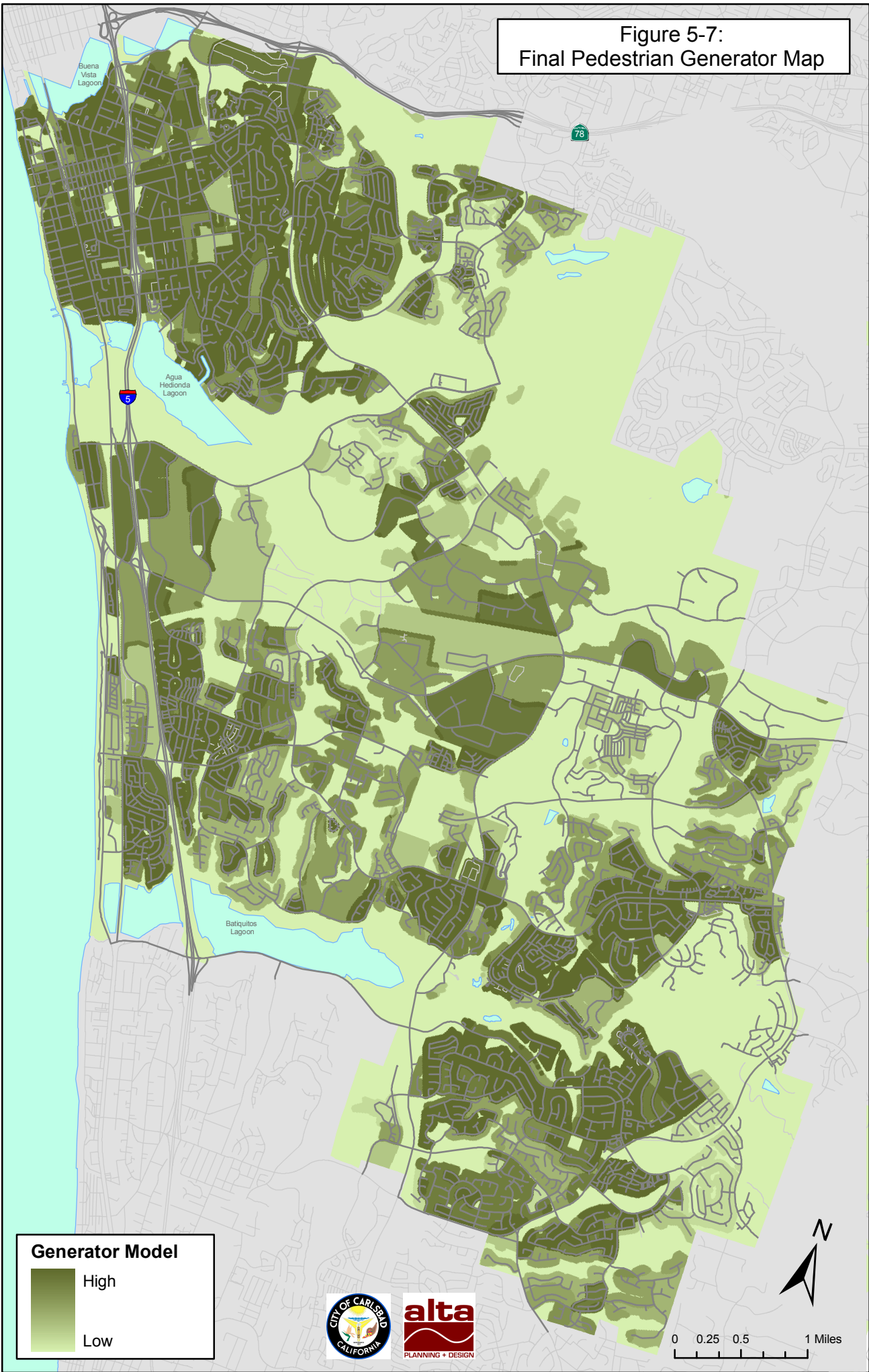


Table 5.1
Pedestrian Generator Weights and Multipliers
Used to Create the Final Pedestrian Generator Map

Pedestrian Generator	Weights	Multipliers	Final Score
Pedestrian Commuters (percent pedestrian commuters by census block)			
> 2	3	2	6
1 - 2	2		4
0.25 - 1	1		2
< 0.25	0		0
Population Density (persons per residential acre by census block)			
> 25	3	2	6
5 – 25	2		4
1 – 5	1		2
Employment Density (employees per nonresidential acre by traffic analysis zone)			
> 15	3	2	6
5 – 15	2		4
1 – 5	1		2
Elderly (population older than 65 years per residential acre by census block)			
> 10	3	1	3
5 – 10	2		2
1 – 5	1		1
<1	0		0
Youth (population younger than 16 years per acre by census block)			
> 10	3	2	6
5 – 10	2		3
1 – 5	1		2
<1	0		0
Disabled (disabled population per residential acre by census block)			
> 5	3	1	3
2 – 5	2		2
1 – 2	1		1
<1	0		0
Land Use Adjacencies (mixed land uses)			
Presence of housing near commercial	2	2	4
Presence of housing near employment	1		2

Sources: Alta Planning + Design; City of Carlsbad Shapefiles, 2000 U.S. Census Bureau, *City of San Diego Pedestrian Master Plan*

Interpreting the weight and multiplier values assigned to one of the generators is useful for understanding this process. In the case of population density, three classes of density were defined (>25 persons per acre, 5 - 25 persons per acre, and <5 persons per acre). Point values were then assigned to the different classes, with higher population densities receiving higher point values. A multiplier value of 1 or 2 was applied to all of the generators. Those generators receiving a multiplier of 2 should have a greater effect on pedestrian activity than those generators receiving a multiplier of 1. The population density generator was assigned a multiplier of 2, meaning that it is more highly correlated with walking than some of the other pedestrian generators. The weight and

multiplier values were similarly applied by the City of San Diego in their *2006 Draft Pedestrian Master Plan*.

As shown in Figure 5-7, the final pedestrian generator map identifies several high-generator areas within Carlsbad, especially within the northwest quadrant of the City, and several smaller high generation areas within the southwest and southeast quadrants.

5.2 Pedestrian Attractors

This section summarizes the distribution of various land use types across the City of Carlsbad that are typically associated with high levels of walking, especially land use types that attract a pedestrian trip. Such land uses include schools, transit stops, parks, beaches, retail, and civic facilities (libraries, post offices, and government buildings).

5.2.1 Schools, Parks, and Other Pedestrian Generating Land Uses

Figure 5-8 displays schools, parks, and other pedestrian attracting land uses. As shown, these land uses are fairly evenly distributed across the City of Carlsbad.

5.2.2 Transit Stops and Ridership

An important focus for pedestrian travel is the public transit system, since a large percentage of transit riders typically do not own cars, and must access the transit system on foot. Carlsbad is served by the North County Transit District (NCTD) which operates a total of 15 bus routes within the City boundary. **Figure 5-9** displays 2005 transit stops within the City of Carlsbad. There are a total of 219 transit stops in the City of Carlsbad, with ridership ranging from 1 to 3,273 daily boardings and alightings. Of the 219 transit stops, only thirteen stops average more than 50 boardings and alightings per day. The NCTD operates the Coaster Commuter Rail which provides service between the City of Oceanside and downtown San Diego. Carlsbad has two Coaster stations, one at Poinsettia Lane and the other at Carlsbad Village Drive. The two Coaster stations and the Plaza Camino Real Transit Center have the highest demand of all transit facilities within the City, averaging over 1,000 boardings and alightings per day.



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Figure 5-8: 2006 Schools, Parks
and Other Pedestrian Attracting Land Uses

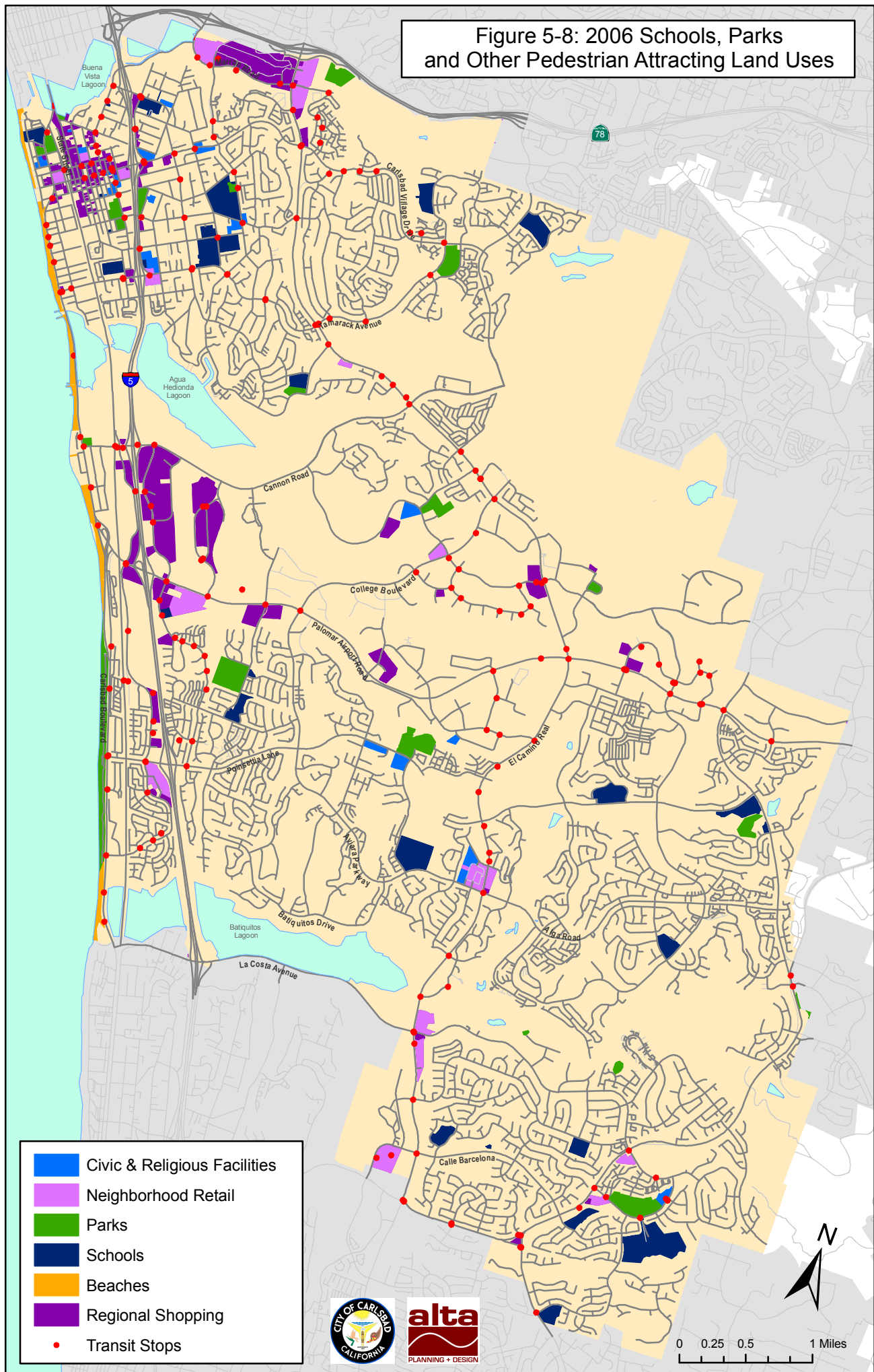


Figure 5-9:
2005 Transit Facilities and Ridership



5.2.3 Final Pedestrian Attractor Map

Figure 5-10 displays the final pedestrian attractor map, as described in the previous sections, for the City of Carlsbad. This map was developed using a GIS tool called Spatial Analyst which combines all of the individual attractors into a single, composite file, with higher values assigned to locations closer to the pedestrian attracting land use and lower values assigned to locations further away from the pedestrian attracting land uses. Whereas the assessment of pedestrian generators was based mainly upon concentration of various population characteristics, pedestrian attractions are assessed in terms of distances to/from the attractor.

Varying weights were assigned to all locations within the City of Carlsbad based upon their proximity to pedestrian attracting land uses. Concentric rings or buffers were created emanating out from the pedestrian attracting land uses. The buffer distances assessed include: within one-eighth mile of an attraction, between one-eighth and one-quarter mile of an attraction, between one-quarter and one-third mile of an attraction, and between one-third and one-half mile of an attraction. Weight values are highest within one-eighth mile of an attracting pedestrian land use, and lowest in locations between one-third and one-half mile of a pedestrian attracting land use.

Table 5.2 displays the distance-based weight values assigned to the respective buffers around the pedestrian attracting land uses.

Table 5.2
City of Carlsbad
Distance-Based Pedestrian Attractor Multipliers

Buffer Distance	Distance-Based Multiplier
Within 1/8 Mile	1.5
1/8 to 1/4 Mile	1
1/4 to 1/3 Mile	0.75
1/3 to 1/2 Miles	0.5
Beyond 1/2 Mile	0.05

Source: Alta Planning + Design, *City of San Diego Pedestrian Master Plan*

Figure 5-10:
Final Pedestrian Attractor Map

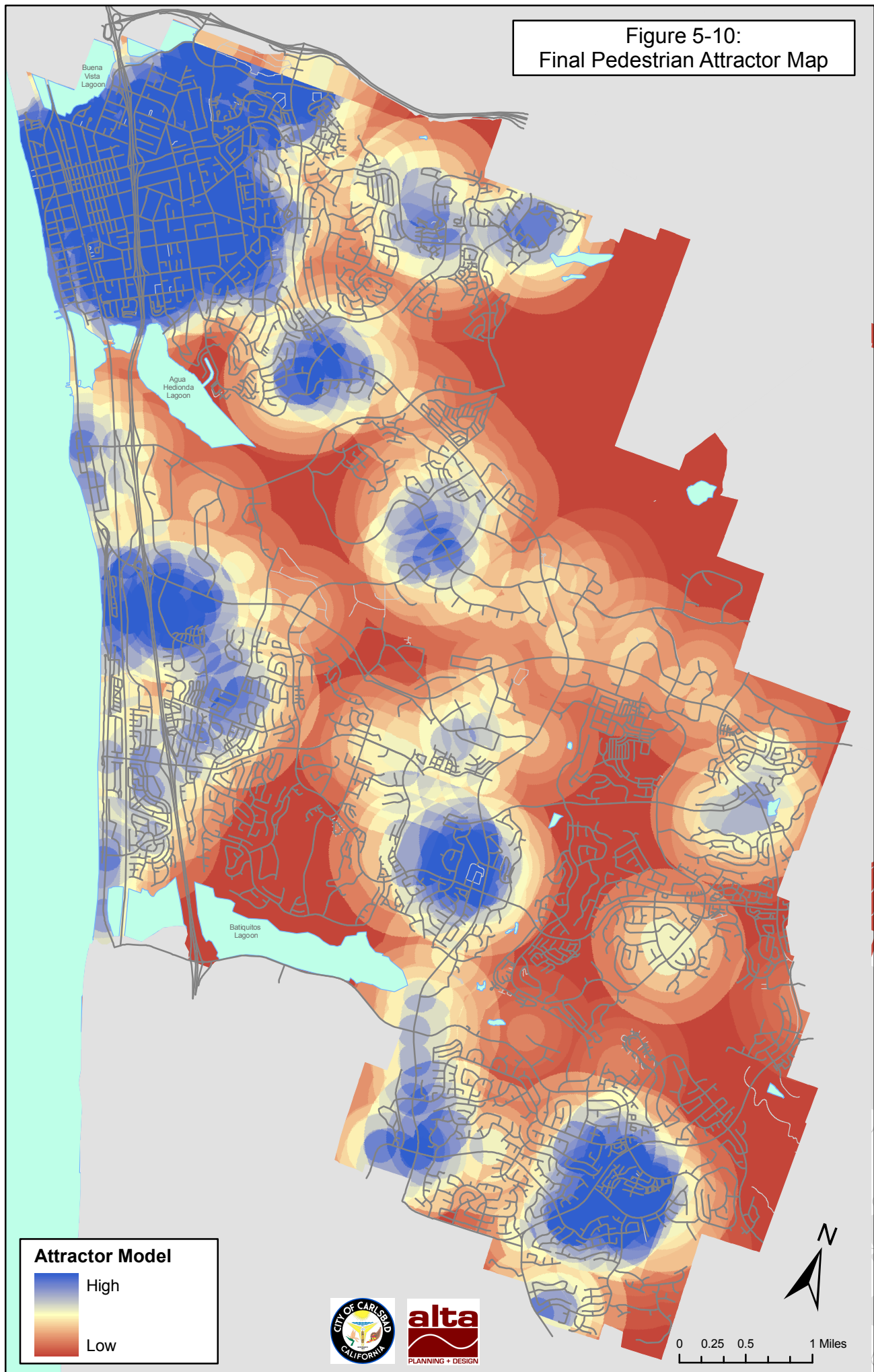


Table 5.3 displays the weights applied to the various pedestrian attracting land uses, along with the associated distance-based multipliers.

Table 5.3
City of Carlsbad
Pedestrian Attractor Weights & Distance-Based Multipliers

Pedestrian Attracting Land Uses	Weights	Distanced-Based Multiplier			
		Within 1/8 mile	Between 1/8 and ¼ mile	Between ¼ and 1/3 mile	Between 1/3 and ½ mile
Major Transit Centers	4	6	4	3	2
Transit Stops	3	4.5	3	2.25	1.5
Elementary Schools	3	4.5	3	2.25	1.5
Middle Schools	2	3	2	1.5	1
Neighborhood Civic Facilities	2	3	2	1.5	1
Retail Facilities	2	3	2	1.5	1
Beaches	2	3	2	1.5	1
Parks & Recreation	1	1.5	1	0.75	0.5
High Schools	1	1.5	1	0.75	0.5

Source: Alta Planning + Design, *City of San Diego Pedestrian Master Plan*

As shown in Figure 5-10, the final pedestrian attractor map identifies several high-attraction areas within Carlsbad, especially in the northwest portion of the City, north of the Agua Hedionda Lagoon. There are also several smaller concentrations of high pedestrian attraction areas between Palomar Airport Road and Poinsettia Lane, along the Interstate 5 corridor, along El Camino Real, and along Rancho Santa Fe Road, between La Costa Avenue and Calle Barcelona.

5.3 Pedestrian Barriers

This section summarizes the distribution of various factors across the City of Carlsbad which tend to discourage people from walking. Indicators of pedestrian barriers include pedestrian/vehicle collisions, high traffic volumes, absence of street lights, high posted speed limits, steep slopes, and un-traversable infrastructure, specifically freeway and rail corridors.

These types of barriers generally undermine broadly accepted walkability goals of safety, connectivity, and walkability. For example, presence of infrastructure and natural barriers inhibit pedestrian network connectivity. High accident rates, high speeds and traffic volumes, and low street lighting coverage are generally indicators of low levels of pedestrian safety. The following sections describe the pedestrian detractors individually and then the methodology for creating a composite detractor map for the City of Carlsbad.

5.3.1 Freeways, Rail and Slopes

Figure 5-11 displays topographical slopes and infrastructure-related barriers, specifically freeway and railroad corridors. Slopes over 25% were considered high pedestrian detractors. As shown, Carlsbad is traversed by several areas with slopes greater than 25%. Two transportation corridors, Interstate 5 and the rail corridor, also run the entire length of the City from north to south, and are significant barriers to east/west pedestrian travel.

5.3.2 Vehicular Travel Characteristics

Figure 5-12 displays existing traffic volumes and posted speed limits. Roadways with high traffic volumes, over 45,000 Average Daily Trips (ADT), were considered high pedestrian detractors, as were roadways with posted speed limits over 45 mph.

5.3.3 Pedestrian Accidents

This section summarizes recent pedestrian-related accidents within the City of Carlsbad. A total of 123 pedestrian-involved crashes in Carlsbad were reported to police between the years 2001 and 2006. **Figure 5-13** displays the distribution of pedestrian accidents across the City. Key findings from this assessment include the following:

- The intersection of Carlsbad Village Drive and Harding Street had 6 pedestrian-involved crashes – the most of any intersection within the City.
- A total of 8 intersections experienced 3 or more pedestrian-related accidents between 2001 and 2006, three of which are along Carlsbad Village Drive at Harding Street, Roosevelt Street, and Jefferson Street. The five other intersections are as follows: El Camino Real/Marron Road, I-5 NB and SB Ramps at Tamarack Avenue, Paseo del Norte/Palomar Airport Road, Monroe Street/Chestnut Avenue, and Pine Avenue/Carlsbad Boulevard.
- A total of 34 accidents (almost 28% of all accidents) occurred in the Village, west of Interstate 5 and within two blocks of Carlsbad Village Drive. An additional 15 took place in the Village to the south of Carlsbad Village Drive and north of Tamarack Avenue.

A total of 17 pedestrian accidents (or almost 14% of all accidents) occurred within a 1/16th mile of a Carlsbad freeway on/off ramp. An analysis of the time of day pedestrian-involved crashes was also conducted and resulted in several key findings. Almost half (49%) of the reported accidents took place between the hours of 1PM and 7PM. The highest one-hour rate of accidents occurred between 2PM and 3PM. Twelve percent of the accidents were reported during the morning peak

Figure 5-11: Steep Slopes and Infrastructure-Related Pedestrian Barriers

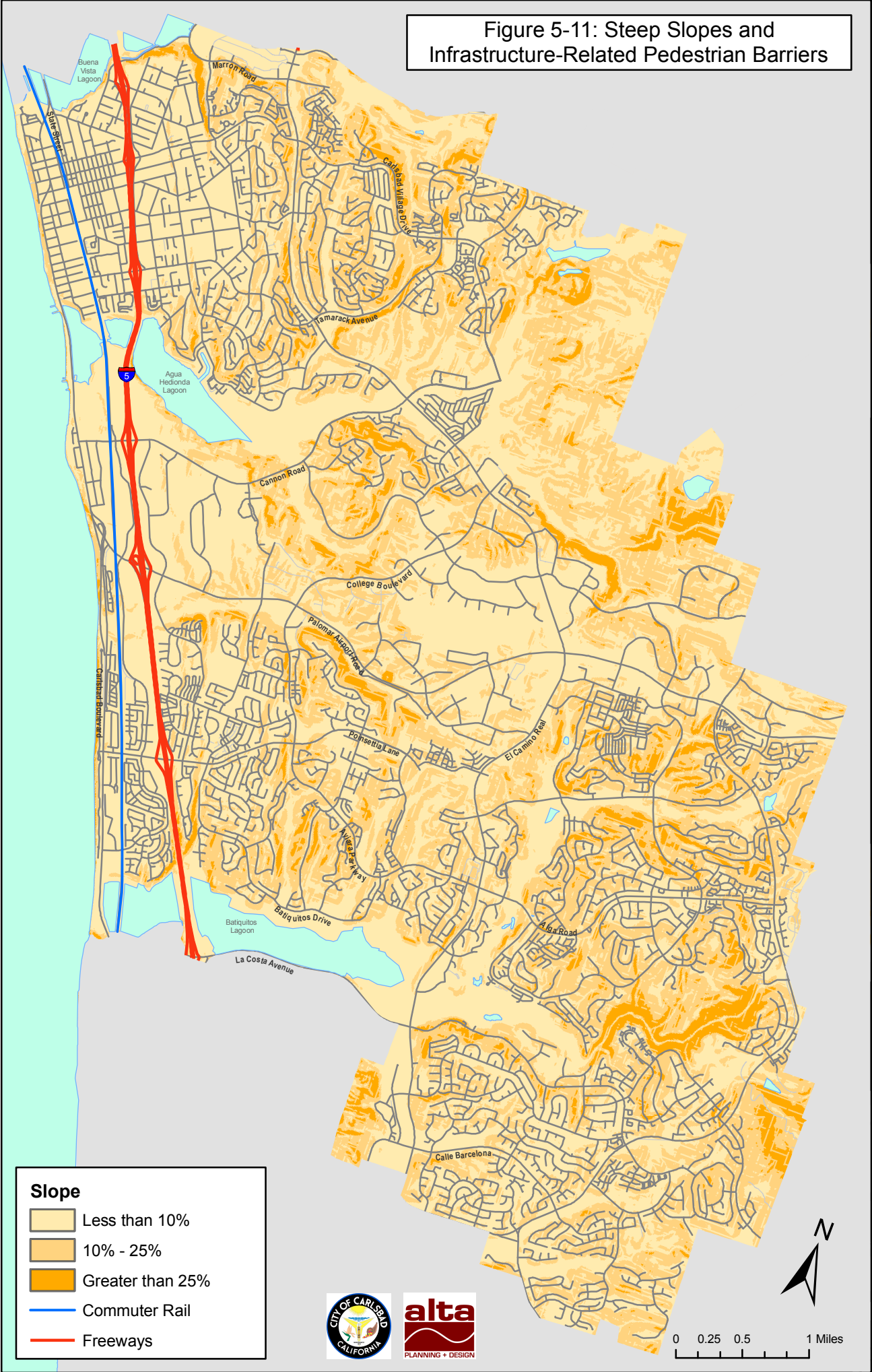
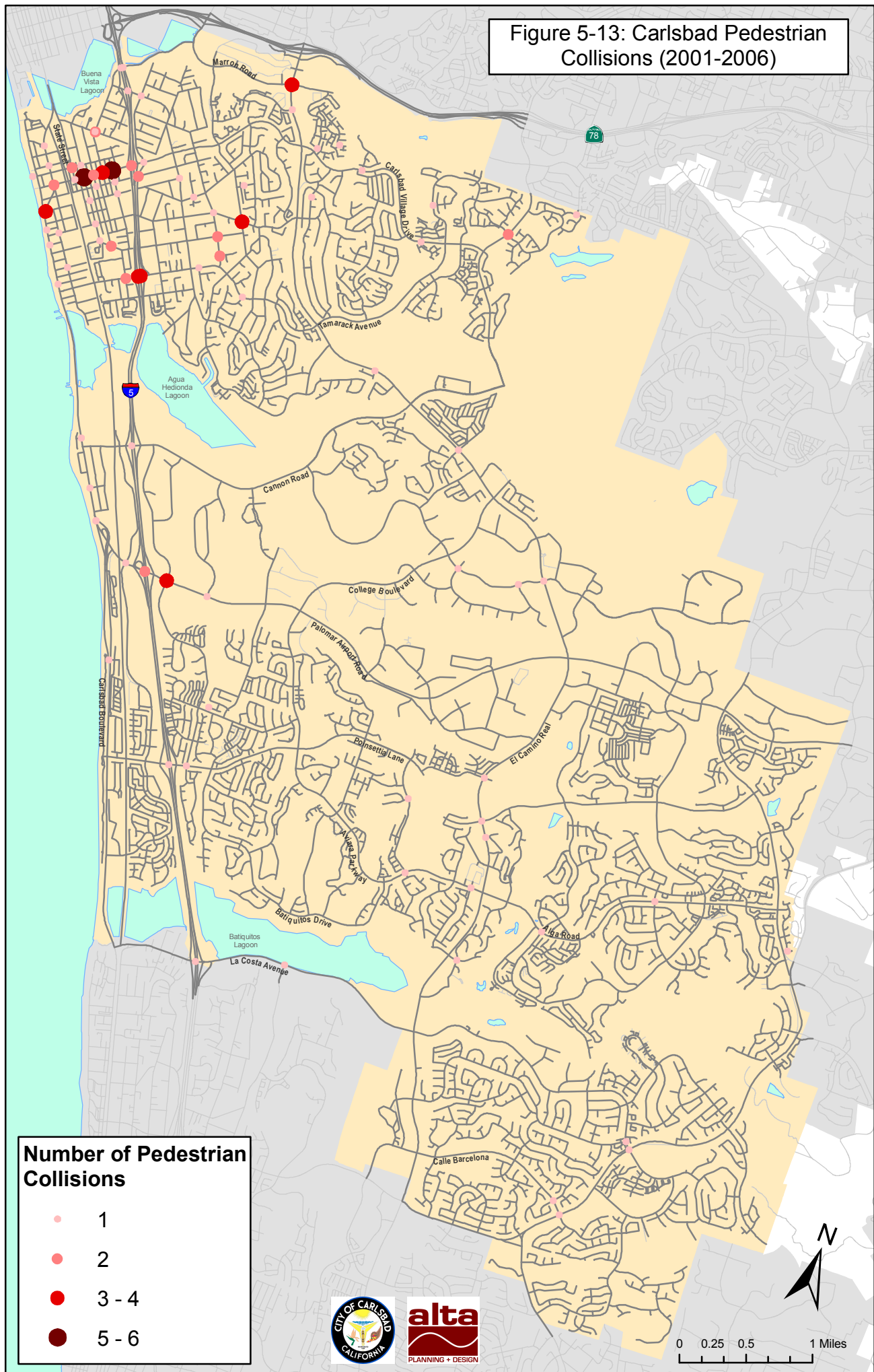


Figure 5-12:
2006 Traffic Volumes and Posted Speeds



Figure 5-13: Carlsbad Pedestrian Collisions (2001-2006)



travel period between 7AM to 9AM, while twenty percent of the accidents involving pedestrians occurred during the afternoon peak travel period (4PM to 6PM).

5.3.4 Final Pedestrian Barrier Map

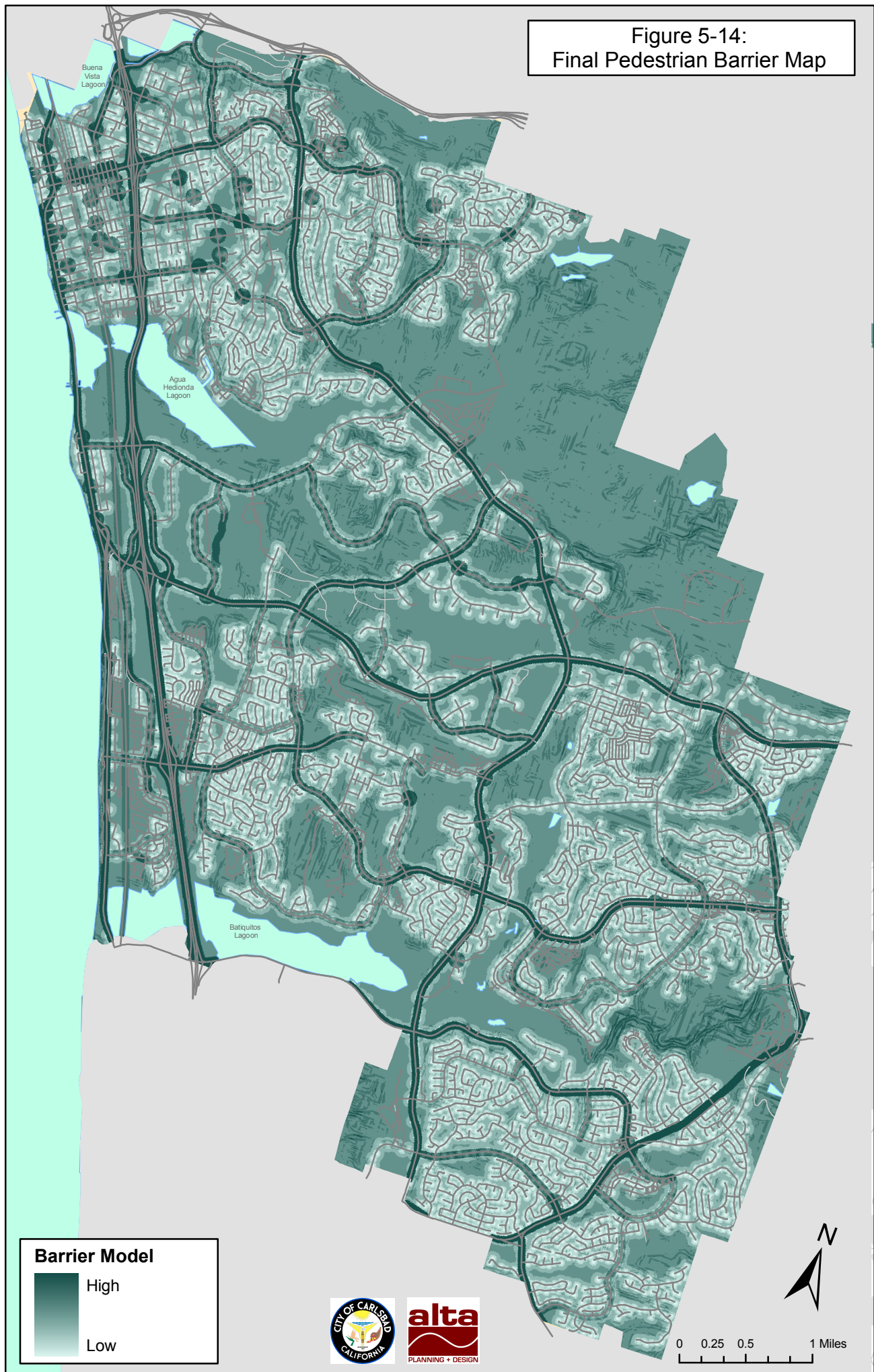
Figure 5-14 displays the final pedestrian barrier map for the City of Carlsbad. The pedestrian barriers are weighted individually, with higher values assigned to locations with higher levels of pedestrian detracting features. Differing multipliers are also applied to the various pedestrian barriers to account for the relatively greater importance of some barriers over others. High barrier areas are weighted with higher point values and multipliers because these locations reflect areas with relatively higher need for pedestrian facility improvements. **Table 5.4** displays the pedestrian barriers, along with the associated weights and multipliers. The weight and multiplier values were similarly applied by the City of San Diego in their *2006 Draft Pedestrian Master Plan*.

Table 5.4
Pedestrian Barrier Weights and Multipliers
Used to Create the Final Pedestrian Barrier Map

Pedestrian Detractor	Weights	Multipliers	Final Score
Pedestrian Collisions 2001 to 2006 (1/16 miles buffer applied to each collision)			
> 1	3	3	9
0.5 – 0.9	2		6
0.001 – 0.5	1		3
0	0		0
Average Daily Trips (ADT)			
>45,000	3	2	6
35,000 – 45,000	2.5		5
25,000 – 34,999	2		4
15,000 – 24,999	1.5		3
10,000 – 14,999	1		2
5,000 – 9,999	0.5		1
< 5,000	0		0
Posted Speed Limits			
>45 mph	3	1	3
35 – 44	2		2
25 - 34	1		1
<25	0		0
Absence of Street Lights			
> 300 feet	3	1	3
150 – 300 feet	2		2
75 – 149 feet	1		1
0 – 75 feet	0		0
Rail and Freeway Corridors			
	1	1	1
Slopes			
> 25%	2	1	2
10% - 25%	1		1
< 10%	0		0

Sources: Alta Planning + Design; City of Carlsbad Shapefiles, SANDAG Shapefiles,
City of San Diego Pedestrian Master Plan.

Figure 5-14:
Final Pedestrian Barrier Map



As shown in Figure 5-14, the final pedestrian barrier map identifies several high-barrier areas within Carlsbad. The freeway, rail, and major arterial corridors appear as significant pedestrian detractors. In addition, several portions of the northwest quadrant have more diffuse areas of high pedestrian detracting features.

5.4 High Pedestrian Need Locations

Three composite maps were constructed and used as the basis for developing a “final pedestrian need” map intended to reflect those areas across Carlsbad that warrant high consideration for pedestrian projects and improvements. The final pedestrian need map incorporates consideration of both those areas with high pedestrian travel demands (in terms of pedestrian trip generation and attraction) and high pedestrian barriers.

Figure 5-15 displays the final pedestrian need map. There are four to five significant concentrations of high pedestrian need across the City of Carlsbad. Those include the following locations:

- The entire northwest quadrant,
- The western coastal area of the City, between Cannon Road and Batiquitos Lagoon,
- Several locations along El Camino Real, at Aviara Parkway/Alga Road and at La Costa Avenue, and
- A large area emanating from the intersection of La Costa Avenue and Rancho Santa Fe Road.

Figure 5-16 defines more discrete Pedestrian Priority Areas that formed the basis for project identification presented in the next chapter.

Figure 5-15:
Carlsbad Pedestrian Need Map

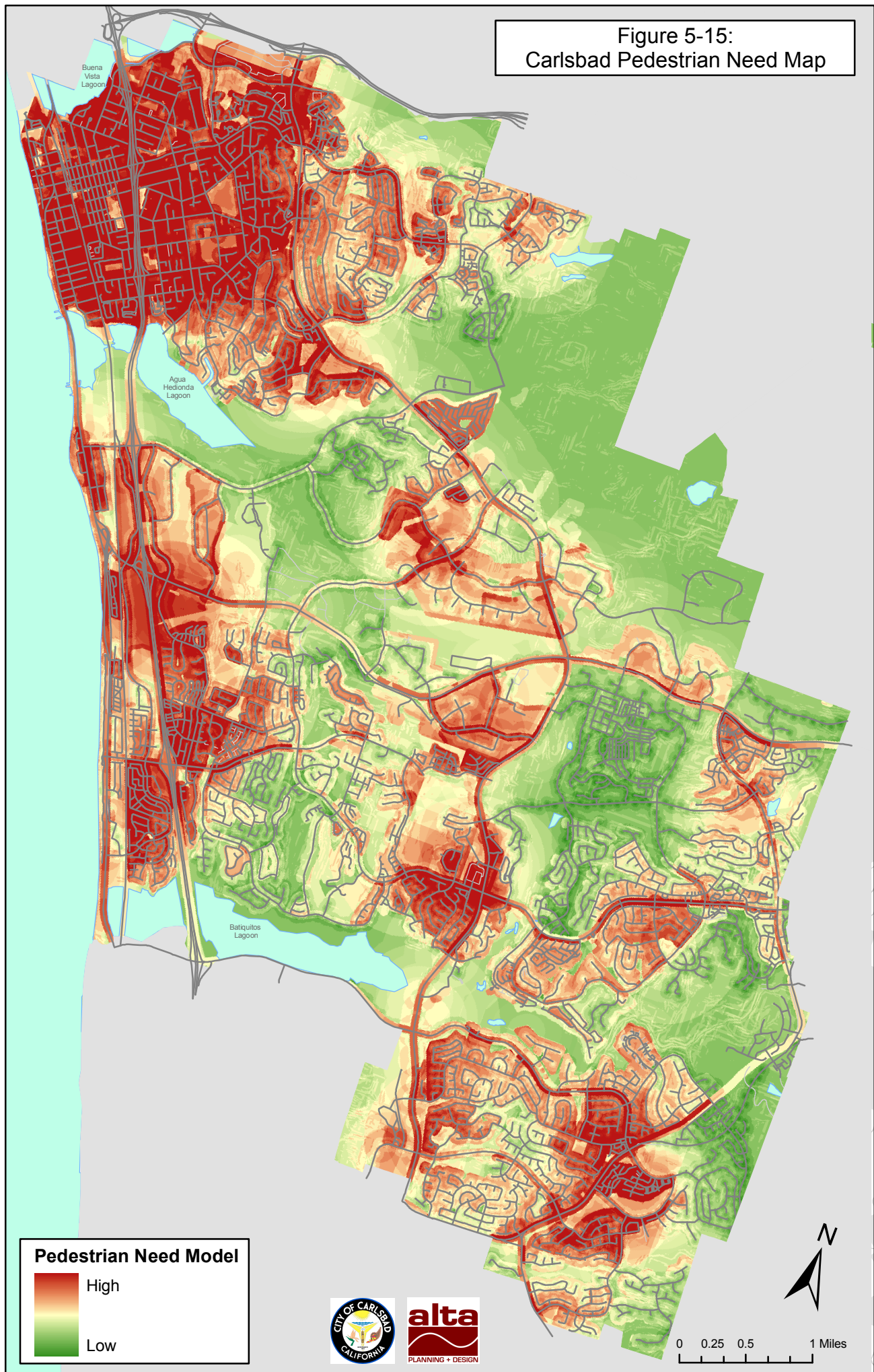


Figure 5-16:
Carlsbad Pedestrian Priority Areas

